Human reasoning process is related to the complexity of the problem being faced

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Abstract: The non-exclusive dual-process working model proposed in De Neys' article effectively makes up for the shortcomings of the existing theories and models, but the explanation of the switching problem and the exclusivity problem in this article cannot constitute a complete rejection of the existing switching mechanism and the traditional fast-slow dual-process model. We believe that a more powerful and logical way of explaining the theory is as follows: human reasoning process is related to the complexity of the problem being faced, and it is also closely related to the reading process of the problem; in the process of reading the problem, the brain will automatically choose different ways of reasoning for the problem of different levels of complexity; and in the process of selection, the principle of minimum energy should still be valid.

Keywords: Dual process; Single process; Intuition; Thinking; Reasoning; Decision-Making; Complexity

In a recent paper (De Neys,2022), De Neys argues that the basic assumptions of the academic community about the mechanism of switching between fast and slow thinking are not empirically supported. In this paper, a more feasible dual-process architecture is proposed (a non-exclusive dual process working model), and its internal logical structure and process are described in detail. This paper makes up for the shortcomings of existing theories and models of human reasoning, however, not all of this article's critiques of existing theories and models are valid (Woo & Spelke2021), and the relevant discussion in this article does not constitute a complete negation of the existing switch mechanism and the traditional fast and slow dual process model (moreover, in Figure 1 of De Neys' paper, the jump from step 2 to step 3 is also a switch mechanism) (Fizke et al. 2017), The reasons are as follows.

It is not hard to find brief evidence to support the above views. For example, in the red-and-white marble experiment, if you are doing this kind of test for the first time, then the reasoning process should indeed be a non-exclusive dual process, it is appropriate to explain it with the non-exclusive dual process model. However, if you have done the exact same test before, or if you are facing a very simple test (such as "The proportion of red balls in the small tray is 1/10, and the proportion of red balls in the large tray is 1/100", or the test is "1+1=?"), then for such questions, single process (system 1, I1) is sufficient to give a clear answer without hesitation (the threshold of least uncertainty can be reached quickly). There is no need to initiate the deep intuitive process (system 2, I2), nor the process of comparing I1 and I2 and the subsequent deliberation process, so this process does not need to have an exclusivity characteristic (Kahneman, 2011; Bargh, J. A., & Ferguson 2000).

For the vast majority of people, when faced with extremely simple problems, especially simple problems that are very familiar, the brain should not need to activate the intuition of System 2 (deep intuition), but only need to activate the intuition of System 1 (shallow intuition). System 1 can quickly give a definitive answer, without the need for dual-process consideration and dual-process comparison (Fazio 2007; Hermans, De Houwer and Eelen2001; Evans & Stanovich,2013).

Therefore, from the existing literature meta-analyses and a large number of existing experimental results, we believe that a more powerful and more logical theoretical explanation is as follows. The brain's reasoning process is related to the complexity of the problem it faces, more specifically: the reasoning process is closely related to the reading process of questions, and during the process of reading questions, the brain will automatically start to activate different processing mechanisms according to different kind of problems:

a. For extremely simple or extremely familiar problems, the brain can quickly give a definite answer after invoking memory and shallow intuition (I1), the uncertainty is very low and reach the lower threshold quickly, so that the output can be given immediately without hesitation. In this case, there is no need to enable the switch mechanism (Dujmović et al. 2021) .
b. For complex or unfamiliar problems, the brain may open the non-exclusive dual process mode, and compare between shallow intuition (I1) and deep intuition (I2), until the uncertainty reaches the minimum threshold, and then give the final result to stop thinking about the problem. In this case, the question of how to switch and whether there are multiple switch mechanisms is involved. For problems of different levels of complexity, the minimum energy principle (minimize cognitive effort) should still be valid in the process of the brain automatically choosing different ways of reasoning (Stanovich & West, 2000).

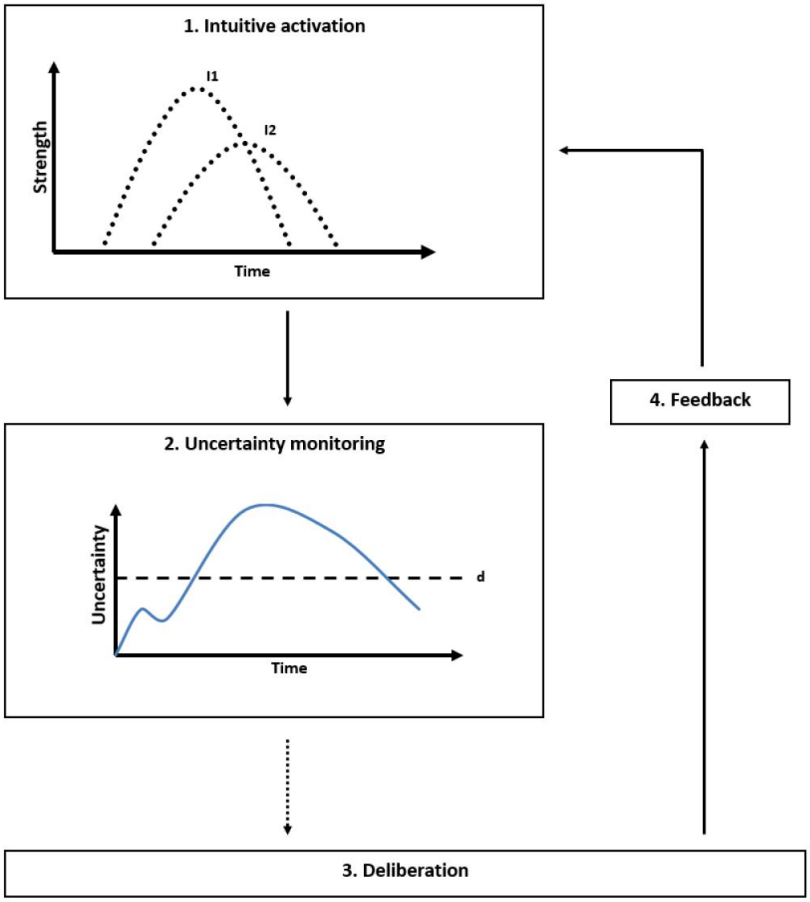

Figure 1. Schematic illustration of the working model's core components. I1 = Intuition 1, I2 = Intuition 2, d = deliberation threshold. The dashed arrow indicates the optional nature of the deliberation stage.

(Note: Above is the Figure 1 of De Neys' paper)

In short, we believe that although De Neys' article (De Neys,2022) is a very valuable breakthrough research on human reasoning, the consideration of the "influence of the complexity of the problem and the degree of personal experience on reasoning process" in this article is insufficient. Therefore, there is still room and necessity to improve the working model of non-exclusive dual process. It is necessary to examine the human reasoning process in a broader framework, including that the reading process should be included in the human reasoning process.

Competing interests. The author has no competing interests.

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